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The following Foreign Honorary Members were elected : —

In Class I. Section 2, Professor C. A. F. Peters, of Königsberg.

In Class III. Section 1, Professor C. Mittermaier of Heidelberg.

In Class III. Section 2, August Boeckh, of Berlin.

In Class III. Section 2, Professor R. Lepsius, of Berlin.

In Class III. Section 2, Chevalier Bunsen, Prussian Ambassador, London.

In Class III. Section 3, G. Grote, of England.

William Raymond Lee was elected a Fellow of the Academy, in the Section of Technology and Engineering.

On motion of Professor Agassiz, it was voted, that the next monthly meeting of the Academy be held on the third Tuesday of June, at half past 7 o'clock, P. M.

Three hundred and eighty-first meeting.

June 21, 1853. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter from William Raymond Lee, Esq., accepting membership of the Academy ; and a letter from the Hon. Timothy Walker, of Cincinnati, acknowledging the reception of the resolutions passed at the annual meeting of the Academy on the death of his brother, Sears C. Walker, Esq.

Professor Agassiz made a communication on the family of Cyprinodonts, of which he had discovered some new generic forms, and twelve new species, in a recent visit to the Southern States. The differences between the sexes are often so marked in this family of fishes, that the males and females have been described under distinct genera. At a former meeting he had mentioned an error of this kind, and he was now able to correct another. *Pœcilia* and *Mollienisia*, described as distinct genera by Cuvier and Valenciennes, he had ascertained to be the male and female of the same species, the

former being the female and the latter the male. When young, both sexes look exactly alike. He had established a new genus, *Heterandria*, in which the sexual differences were very remarkable; the position and shape of the ventral and other fins being quite different, which he showed by diagrams. The habits of these fishes, living in immense numbers, crowded together in very shoal water, enabled him to explain a figure represented in the fifth volume, Plate 41, of his Fossil Fishes, in which the great number of individuals was remarkable; and the knowledge of the sexual differences renders unnecessary any hypothesis to account for supposed displacements of fins, or the occurrence together of different species. He also had established a new genus, *Zugonectes*, in which no sexual differences existed.

Dr. Burnett read a paper

“ On the Signification of Cell-segmentation, and the Relations of this Process to the Phenomena of Reproduction. ”

“ The phenomena of the segmentation of cells are intimately connected with many of the highest conditions of organization, and it becomes a question of no little interest in physiology, what interpretation is to be put upon this process of segmentation.

“ By the term Cells, I include, not merely the elementary constituent particles of organized forms, but also ova, for it now appears pretty definitely settled that the ovum is, *morphologically*, only a cell; of this point, deducible from the observation of various naturalists upon the elementary condition of ova in different lower animals, I have recently satisfied myself, from investigations upon the ovaries of insects. Moreover, the segmentation of the ovum as preliminary to the formation of a new individual involves physical phenomena not in the least different from those of this process occurring with simple individual cells.

“ This process consists, as is well known, in the successive halvings of the nucleus of a cell, the number of the parts produced being, therefore, whether greater or less, the multiple of *two* in a geometrical progression. Its physical conditions are, briefly, first, a sulcation of the cell membrane at one point; the concavity thus commenced gradually deepens and extends through the cell, ending in the com-

plete halving of the cell, together with its contents; each of the halves thus formed undergoes the same process of division, and so on to a greater or less number of subdivisions, the products being, not segments of a sphere, as would be the case from the division of inorganic matter, but miniature cells, resembling, in every particular except mere size, the original cell. This spontaneous division and subdivision of organic matter, by which definite particles reproduce their kind, lies at the very foundation of the successive continuation of all specific organized forms in the vegetable and animal world.

“Until late years, this process of segmentation was supposed to belong exclusively to the impregnated ovum, and to be the index of its state of fecundation. Recent researches in histology, however, have shown, not only that it is a very common phenomenon with most individual cells, but also that it may occur in the ovum before fecundation; that is, is not the direct sequela of this last. In epithelial cells, as also those belonging to various morbid growths, I have watched this process occurring exactly as with the ovum; and in the ova of the common codfish (*Gadus morrhua*), before expelled from the ovaries, and therefore before impregnation, I have seen phenomena indicating that the segmentation of the vitellus had already commenced.

“But we will examine the details of this process as occurring where they are mostly completely expressed, in the impregnated egg. Throughout the entire organized world, the development of new individual forms from the ovum which has its origin in a proper sexual organ, is always preceded by this process, to a more or less complete extent; this segmentation may, indeed, go on to a certain extent before fecundation, as already remarked, but its continuance ending in the evolution of a new individual form is invariably dependent upon the act of fertilization by the male product, or sperm. I wish to insist upon this point in reference to some remark soon to be made. It may be said further, that not only is the whole individual formed out of the segmentation products, but at those points of the animal which contain tissues of the noblest function is always the most complete; such, for instance, is the case with the line of the nervous centres.

“The sperm-cell being the analogue of the ovum, these same phenomena, just described, are observed to precede the formation of the spermatatic particle, and I can confidently affirm that no spermatatic particle is produced without the occurrence of these preliminary processes.

“With such data, and which are, indeed, all we possess, we ask, What is the physiological signification of this fissurating process in cells ?

“To this I would reply, that it seems to be simply an expression of a vitalizing act,—a means by which cell-particles are extended or reproduced on the one hand, and, on the other, by which crude materials of organized matter are kneaded or worked over for the formation of *tissue* in distinct individual beings.

“Thus with simple cells, with the unimpregnated ovum, and with the sperm-cell, this process occurs, leading to a mere reproduction or multiplication of the cells, and which may continue to a greater or less extent ; while, on the other hand, with the impregnated ovum, these processes, although physically the same, are directed from the fecundating act towards a definite end, that is, the formation of *tissues* which compose a new being.

“In this connection, I may well allude to those anomalous phenomena, the successive reproduction of individuals without the aid of the male influence, as occurs with the Aphides. The general character of this form of multiplication of individuals is well known in science ; but what I wish to insist upon now is, that these phenomena, as I have recently studied them, have nothing antagonistic to the doctrines of cells just advanced, for the so-called eggs of the viviparous Aphides, and which develop without the aid of the sperm, are, in my opinion, not true eggs, but are rather *buds*, and therefore development here occurs by a kind of *internal germination*. But this subject of the development of Aphides in its details, as I have recently enjoyed the opportunity to successfully study it, I intend to present at the next meeting.

“Cell segmentation, therefore, is a vital act of cells as organic particles, and is primary instead of secondary in the grand acts of true generation.

“This subject, important as it is in itself, has a wide physiological bearing. If such phenomena invariably attend the production of a new individual form from a true egg, can there be, as has recently been advanced by several physiologists, animals composed of only a single cell ? To this question the answer would be in the negative ; and such forms would seem to me no more worthy to be regarded as true animals, than would be the resultant products of segmented epithelial cells.

“On the very lowest confines of the animal kingdom there are,

to be sure, myriads of such forms, and if, in the present state of science, they can consistently be called by any name, I should prefer that of *Zooids*, or animal-like forms. They appear to me to be intermediate conditions of bodies, or a kind of stepping-stones, by means of which some future true animal is to reach its perfect form. Modern research in the class of Infusoria indicates that its component forms are of this kind, and therefore that this whole class is likely to be taken by the remaining classes of the Invertebrata, when more extended study shall have made us more familiar with their details. I would therefore insist that cell-processes, however closely interwoven they may be with the expressions of individual life, cannot be considered as constituting the ground-work of its definition. True individual animal life seems to involve a cycle of relations not implied in simple cells; in other words, these last must always lose their character as such, in a definite form which belongs to the individual. The true generative act involves conditions which are peculiar and quite distinct from any of the other physiological conditions of life; it must be regarded as resulting only from the conjugation of two opposite sexes, — a sexual process where the potential representatives of two individuals are united for the evolution of one germ. The germ-power thus produced may be extended and branched by budding, &c., but it can be formed only by the act of generation; and the multiplication of animals by the processes of fission or of germination is of no higher physiological character than the mere segmentation of cells, or the reproduction of lost parts in the lower animals."

Professor Agassiz observed, that there was only an *analogy* between the segmentation of simple cells and the segmentation of the ovum, and went on to show the difference of the phenomena presented in the two cases.

As to the egg-like bunches, mentioned by Dr. Burnett as found in the bodies of the Aphides, and considered by him as "buds," and not as true "eggs," Professor Agassiz could not agree with him. From the absence of peduncles, these free cells had not the first characteristic of buds, and he was inclined to consider them rather as true eggs. He mentioned the instance of turtles, in which there are three kinds of eggs in different stages of fecundation or growth, some to be laid this

season, and others after a lapse of one or two years, which have received their fertilizing influence from the male this long period in advance. Speaking of the development of eggs, he alluded to the fact that in bees there are two kinds of females produced from eggs, which, in the beginning, present no differences; every female bee might become a queen if properly fed and cared for, but from want of the proper surrounding influences most of them become sterile. In some species of crabs, he had found also two kinds of females, fertile and sterile, though, unlike the bees, existing in about the same numbers.

Dr. B. A. Gould, Jr. made some remarks on the means of diminishing the personal equation, or the best method of getting rid of personal errors in transit observations made by different observers. He quoted M. Arago, from the *Comptes Rendus* for February 14, 1853, in which he claims priority for the method of employing the senses of sight and *touch* to diminish the personal equation, instead of sight and *hearing*, as usually employed; this method of tapping at the instant the star passed the threads of the instrument dates back to 1843.

Dr. Gould mentioned a similar method employed at Philadelphia, some time between 1828 and 1832. The best way, he believed, was that employed in our Coast Survey, by the electric clock, by breaking the circuit by a tap of the finger at the instant of the transit.

The problems, why sight and hearing should be less accurate than sight and touch, why observers should differ from each other, and why the same observer should differ from himself in the same manner of observation, are exceedingly difficult to solve; they involve the consideration of temperament, physiological conditions, state of the health, mechanical dexterity, &c., which make the subject exceedingly intricate.

Professor Bache, Professor Peirce, Professor Agassiz, and the President made remarks on the same subject.